

AD-A181 171

CONSISTENCY MANAGEMENT MECHANISMS: ANALYSIS AND
PERFORMANCE(U) TEXASUUNIV AT AUSTIN DEPT OF COMPUTER
SCIENCES J C BROWNE ET AL 29 MAY 87 N00014-83-K-0490

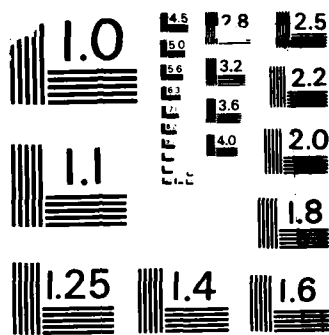
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THE UNIVERSITY OF TEXAS AT AUSTIN

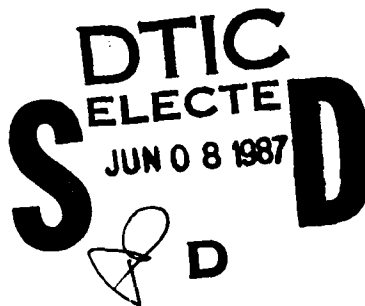
Department of Computer Sciences
Austin, Texas 78712
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29 May 1987

Dr. Charles Holland/Code 1133
Office of Naval Research
Ballston Tower No. 1
800 Quincy St.
Arlington, Virginia 22217-5000

Dear Sir:

RE: N00014-83-K-0490

1. Contract Information

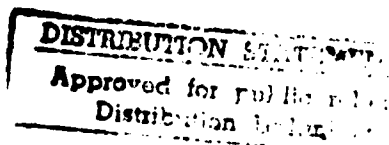
This is the Final Technical Report for ONR Contract Number N00014-83-K-0490, entitled "Consistency Management Mechanisms: Analysis and Performance." The principal investigators are Dr. J. C. Browne and Dr. A. Silberschatz.

2. Summary and Research Significance

→ In the research performed under this grant we evaluate the applicability and performance impacts of mechanisms for consistency management. We analyze and evaluate the applicability and performance properties of procedures which have been previously proposed, and develop formulations and mechanisms for consistency and integrity management which are performance effective as well as being functionally correct over a spectrum of environments. The foundation for the analysis is the establishment of a framework for classifying and constructing appropriate concurrency control mechanisms. The workload descriptions are based upon analysis and measurement of existing systems. Our approach combines theoretical analysis with systematic experimentation and modeling. The modeling framework extends from analytically based searches of parameter space to very detailed trace driven models which have accuracy approaching that of measurement of the executing systems. ←

The results obtained have led to the development of a family of protocols which improve concurrency and preserve consistency in distributed databases. The protocol family is the first in which segments of the database may have multi-versioned or uni-versioned entities, independent of other segments. Correctness with respect to consistency and absence of deadlock is established in that the protocols require no global sequencing mechanism and do not abort partially completed transactions.

Simulation studies which evaluate the performance of this family of protocols show that at heavy workloads, the proposed protocol qualitatively outperforms existing protocols, including the two-phase locking protocol. The primary contribution then, is the extension of the affordability domain of consistency protocols to higher workloads.



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3. Publications

1. Kadem, Z. and A. Silberschatz, "Locking Protocols: from Exclusive to Shared Locks," Journal of the ACM **30**, 4 (October 1983), 787-804.
2. Buckley, G. and A. Silberschatz, "On the Heterogeneous Guard Locking Protocol," The Computer Journal **27**, 1 (Feb. 1984), 86-87.
3. Silberschatz, A. "Cell: A Distributed Computing Modularization Concept," IEEE Transactions on Software Engineering **10**, 2 (March 1984) 178-185.
4. Mohan, C., Fussell, D. and A. Silberschatz, "Compatibility and Commutativity of Lock Modes," Information and Control **61**, 1 (April 1984) 38-64.
5. Mohan, C., Kadem, Z., Fussell, D. and A. Silberschatz, "Lock Conversion in Non-Two-Phase Locking Protocols," IEEE Transactions on Software Engineering **11**, 1 (January 1985) 15-22.
6. Silberschatz, A. and G. Buckley, "Beyond Two-Phase Locking," Journal of the ACM **32**, 2 (April 1985) 314-326.
7. Kant, K. and A. Silberschatz, "Error Propagation and Recovery in Concurrent Environments," The Computer Journal **28**, 5, (November 1985), 466-473.
8. Ramakrishnan, I.V., Fussell, D. and A. Silberschatz, "On Mapping Homogenous Graphs on a Linear-Array Processor Model," IEEE Transactions on Computers **35**, (March 1986), 189-209.
9. Silberschatz, A., "On the Synchronization Mechanism of the Ada Language," Hawaii International Conference on System Sciences, January 1984.
10. Buckley, G. and A. Silberschatz, "Concurrency Control in Graph Protocols," ACM SIGACT-SIGMOD Symposium on Principles of Database Systems, March 1984.
11. Breitbart, Y., Kemp, M., Thompson, G., and A. Silberschatz. "Performance Evaluation of a Simulation Model for Data Retrieval in a Heterogenous Database Environment," IEEE Conference on Trends and Applications, March 1984.
12. Buckley, G. and A. Silberschatz, "A Fault Tolerant Centralized Mutual Exclusion Algorithm," Fourth International Conference in Distributed Computing Systems, May 1984.
13. Mohan, C., Browne, J.C., and A. Silberschatz "Optimal Throughput Scheduling for Distributed Concurrent Execution and Database Systems," 1984 International Conference on Parallel Processing, August 1984.
14. Buckley, G. and A. Silberschatz, "Eliminating Cascading Rollback in Structured Databases," Conference on Foundations of Theoretical Computer Science, December 1984.
15. Buckley, G and A. Silberschatz, "A Concurrency Control Scheme with Predeclared Read and Write Sets," Hawaii International Conference on System Sciences, January 1985.

16. Korth, H. and A. Silberschatz, "A User Friendly Operating System Interface Based on the Relational Data Model," International Symposium on New Directions in Computing, August 1985, (also technical report UT TR-84-12).
17. Ramakrishnan, R. and A. Silberschatz, "The MR Diagram - A Model for Conceptual Database Design," Eleventh International Conference on Very Large Data Bases, August 1985.
18. Ramakrishnan, R. and A. Silberschatz, "Annotation for Distributed Programming in Logic," ACM SIGACT-SIGPLAN Symposium on Principles of Programming Languages, January 1986, (also technical report UT TR-85-15).

6. Program Participants

The following students participated in the research as graduate research assistants:

Yeturu Aahlad
 Mohan Ahuja
 Lewis Barnett
 Munir Cochinwala
 Gad Dafni
 Raghu Ramakrishnan
 Donald Stuart

Mohan Ahuja completed the Ph.D. degree during the period of this grant.

Sincerely,

A. Silberschatz
 Abraham Silberschatz
 Professor

J. C. Browne
 J. C. Browne
 Professor and Chairman



Accession For	
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